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Research Article

Integration of Artificial Intelligence and SAP in the Supply Chain Management of Healthcare Industry

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Abstract *- Technology is evolving day by day; thus, organizations and businesses must keep pace with the latest developments. In the past few years, the use of Artificial Intelligence (AI) has gained significant attention. AI in SAP-Enterprises Resource Planning (ERP) is becoming increasingly significant in the rapidly evolving Enterprise. There are a lot of existing studies available on SAP-ERP systems. However, only limited research has been conducted on examining the adoption of AI in ERP systems, particularly in healthcare management. Therefore, the goal of this research is to examine the supply chain-based inventory-sharing system in SAP-ERP using the integration of AI. A questionnaire sample of data has been taken from 379 respondents of hospital administration employees and patients from several hospitals in major cities in India using a convenience sampling technique. The result of a study shows that AI in SAP-ERP implementation systems has a positive and significant impact on the hospital management system and improves hospital management products and services. Further, the study revealed that adopting AI-driven ERP solutions helps to achieve greater efficiency in healthcare businesses and enhance their agility by reducing costs and giving them a significant edge in the competitive market.*

Keywords *- Enterprise Resource Planning, SAP, Supply chain management, Artificial Intelligence, and Health care systems*.

1. Introduction

In the dynamic and interconnected landscape of modern supply chain management, the integration of Predictive Analytics, Systems, Applications and Products (SAP) and AI heralds a new era of efficiency, foresight, and strategic decision-making [1]. The supply chain is crucial for every business that moves goods and services from supplier to customer. AI can help the firm identify potential issues quickly by providing insights into the supply chain performance and enabling the firm to make proactive decisions [2]. SAP is the market leader for enterprise resource planning software. Competitors of SAP range from smaller software companies to large, diversified software companies and offer enterprise software as part of a larger portfolio of other software products [3, 4].

Supply Chain Management (SCM) and Enterprise Resource Planning (ERP) Systems are two of the most popular components of enterprise solutions. SAP-SCM provides different solutions that enable the business to conduct supply chain planning and generate high-efficiency business processes [5]. ERP systems serve as the foundation of organizational operations in today's corporate environment by simplifying procedures and maximizing resources. Implementation of the SAP-ERP system's automated production process planning unit results in a decrease in the amount of time needed to maintain the production planning process.

Further, it improves production process management, lowers costs, and increases overall enterprise productivity and investment appeal [6, 7]. In healthcare organizations, a simple digital ERP application is employed for delivering innovative outcomes to develop novel healthcare technology products that employ complex algorithms to deliver solutions to platforms that use AI for various innovative solutions [8, 9, and 10]. A pictorial depiction of AI adoption of ERP in the healthcare business is sketched in Figure 1.

1.1. Problem Statement

Generally, most of the existing literature on ERP systems has studied its implementation in organizations. The requirement of supply chain inventory on the SAP-ERP system by the organization is based on organization type (manufacturing or services), size of the organization, location, and quality and quantity of data generated. Health care is one such sector where the data generated needs proper treatment. Here, the role of the ERP system becomes profound. However, not many studies have been done on this sector with respect to the digital adoption of AI in SAP-ERP. Therefore, this study aimed to analyze the inventory sharing system in SAP-ERP in the healthcare sector within the integration of AI.

1.2. Research Objectives

The broad objective of the study was to examine the integration of AI in SAP ERP, while the specific objectives are,

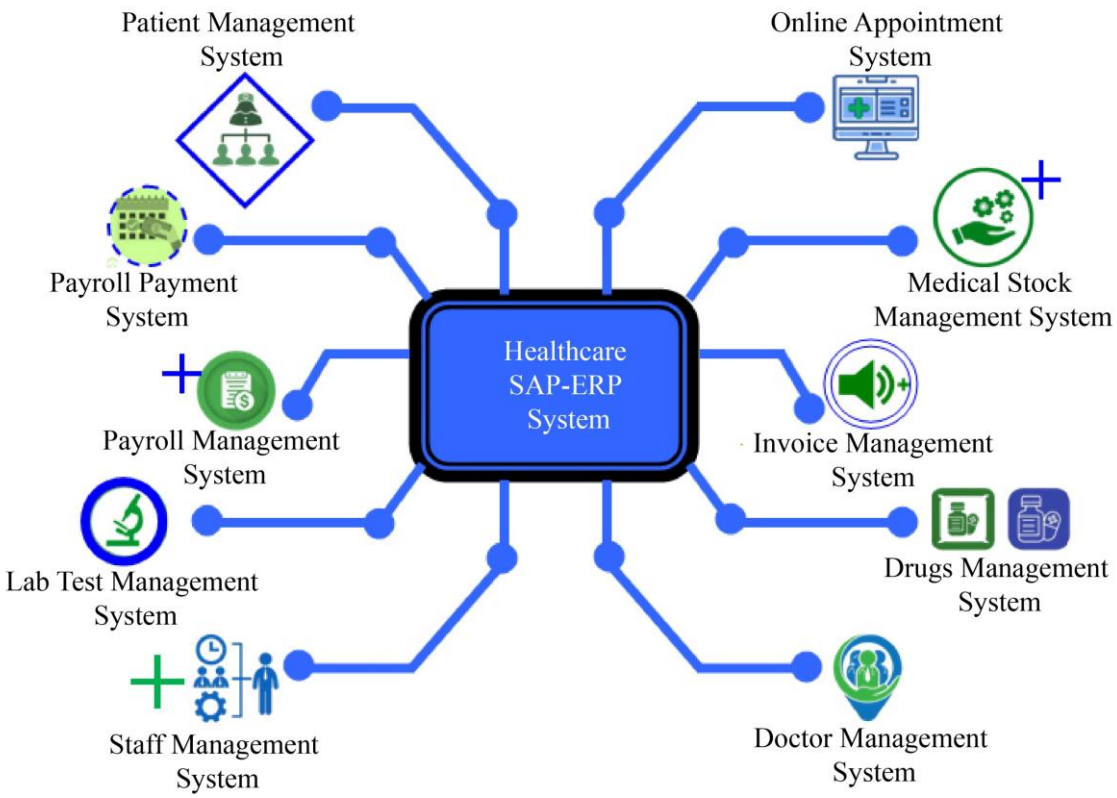

Fig. 1 Digital transformation of AI in healthcare management

- To explore the impact of AI implementation of SAP-ERP system on the operational factors of the health care units.
- To examine the barriers to the implementation of AI in the usage of SAP-ERP systems.

The main part of the article includes the following sections: related literature review, presentation of proprietary research methods, and analysis of principal results and discussion. Finally, the interpretation of the results and future scope of the study are outlined in the concluding section.

2. Related Literature Review

This section highlights issues that warrant further consideration with respect to the relevance of best practices of SAP-ERP embedded in healthcare systems using digital transformation of artificial intelligence and their implementation and use in different organizational contexts.

Seyed Ali Nemati and Dinesh Mangala Durai [11] intended the impact of enterprise resource planning in the management of the supply chain. The data were collected based on the Enterprise Resource Planning (ERP) and analyzed by the deductive research approach. The research result pointed out that the importance of a long-term relationship was enlightened in small and medium enterprises, and ERP had a positive impact on supply chain management. The limitation of the study was that the research was based on cross-organizational decision-making modeling and focused only on the integration of analytical systems with ERP systems. Also, the study did not consider the ERP in supply chain management.

Christos Bialas *et al.* [12] investigated the digitalization of Enterprise Resource Planning (ERP) systems through the healthcare supply chain in hospitals. The data was collected from 107 Greek public hospitals, and the framework was evaluated through Structural Equation Modeling (SEM). The result of the data was analyzed by confirmatory factor analysis. Results of the study demonstrated that a statistically significant association was observed between the ERP systems and hospital supply chain costs. The limitation of the study was that the data were collected from Greek public hospitals and the private hospital's data were excluded in the study.

Nikhitha Yathiraju [13] explored the use of an ERP Cloud-Based System in a model of Artificial Intelligence. Data were collected by using purposive sampling from five AI experts, such as three Machine Learning (ML) experts, five Cyber security experts, and two Cloud Service Providers. The findings in the study illustrated that AI was a technological innovation and provided a positive significance to individuals and organizations to improve management performance. The

study only considered 15 experts while interviewing, which affects the generalizability of the findings.

Iryna Lukyanova *et al.* [14] examined the ERP system types and the impacts in the humanitarian and private sectors on supply chain management. Samples were collected through the survey questionnaire from 50 humanitarian supply chain professionals and 53 private sector professionals. The collected data was analyzed by the descriptive statistic cross-tabulation analysis, which shows the differences between the similarities in the responses of humanitarian and private sectors. The Mann–Whitney Test tested the research hypotheses. The findings highlighted the impacts of ERP systems on supply chain performance and confirmed that the impacts on both sectors were similar. The study only considered the humanitarian and private sectors. However, the factors related to other organizations were not considered, which was the limitation of the study.

Oluwasegun Julius Aroba and Prinavin Govender [15] analyzed the digital transformation of ERP systems through supply chain management processes in the industry such as oil and gas. The data were collected from the 55 managers by the structured questionnaire. The qualitative desktop approach was used to identify the study findings. Using Cronbach's alpha, the internal consistency and reliability were examined in the supply chain management process. The results showed that there was a positive impact on the cloud ERP systems in oil and gas companies. Also, the result was higher than the analysis of the Cronbach Alpha reliability co-efficient score; the qualitative analysis output was similar. However, the study was limited to only the oil and gas sector, but the same results were not applicable to other sectors.

Makori Edna Kwamboka [16] illustrated the ERP applications and supply chain performance of large-scale manufacturing firms. The target data were collected from the survey questionnaire of large-scale manufacturing firms in Nairobi. The study adopted a descriptive design for the analysis, and a stratified random sampling technique was used to analyze the collected firms. Collected data was analyzed by using the regression analysis. The study findings pointed out the successful implementation and effective usage of ERP applications towards the supply chain management performance. The study was limited to the geographical area of Kenya. Moreover, the study considered only the applications of ERP and the supply chain performance of large-scale manufacturing firms; however, the study does not consider the other regions.

Stella Chepkoech and Ismail Noor [17] focused on the effects of ERP implementation on supply chain performance in the manufacturing sector. The descriptive research design was applied to collect the target population from 300 respondents. The collected samples were analyzed by using purposive and probabilistic sampling techniques. Data was analyzed by using descriptive statistics. The study result concluded that the management had been very supportive of ERP Implementation. However, the management did not pay attention to problems that arose during the implementation of ERP. Thus, the top management did not emphasize the ERP implementation. The study results only focused on the region of Kenya, whereas the same results were not obtained in other geographical areas or regions.

3. Research Methodology

3.1. Research Design

The focus of this research study is to explore the supply chain-based inventory sharing system in SAP-Enterprise resource planning using artificial intelligence. Additionally, this study explored the barriers and challenges that hinder the implementation of AI in the usage of SAP-ERP systems in healthcare system units. The study uses a descriptive research design to analyze the integration of AI in the SAP-ERP system. The design presents data in a meaningful manner, which facilitates the understanding of the attributes of a group in circumstance and helps the researcher to reach logical conclusions. The diagrammatic depiction of the SAP-ERP success model is shown in Figure 2.

3.2. Study Setting and Sample Collection

The statistical population of this study consists of various healthcare units from major cities in India. A total of 500 respondents were considered in this study. After the final sample collection, only 379 out of 500 respondents properly completed the structured questionnaire, and others did not properly reply to the structured questionnaire. The remaining 121 respondents were deemed as unfit, invalid, and inappropriate to the structured questionnaire, so they were eliminated in this research. Additionally, selecting participants from different domains ensures that the study captures a diverse range of perspectives and experiences.

3.3. Study Instruments

Based on the findings of a qualitative study conducted in the same area, factors associated with SAP-ERP with the integration of AI were examined. Questions were developed based on these factors. Before administering the questionnaire, the details of the study were clearly explained, and verbal informed consent was obtained by the researcher from each participant.

3.4. Data source

The study used primary data, which was collected through self-administered interviews containing closed questions. The questionnaire was designed on a Likert-type scale. A questionnaire is considered the data collection instrument of choice, and it is easy to formulate and administrate the research analysis. It also provides a relatively simple and straightforward approach to the study of attitudes, values, beliefs, and motives. Primary data are the original data that are gathered directly from the empirical field investigation. Based

on the questionnaire survey, primary data has been collected. A secondary source of data has been gathered from various articles, journals, magazines, etc.

3.5. Data Analysis

For obtaining the basic data and trends regarding the presented research, convenience sampling has been preferred. This technique is efficient and effective with respect to the time, effort, and money spent on data collection. The questionnaire is pre-tested to ensure that the questions are clear and easy to understand. This study enables the researcher to collect data that is accurate and relevant to the research objective. The data collected was analyzed using descriptive statistics (measures of central tendency and measures of variance). Additionally, the regression analysis has been applied to test the significant difference. Furthermore, the hypothesis of a study has been formulated to find the relationship between the success factor of AI integration in SAP-ERP and healthcare systems.

3.6. Validity and Reliability of Research Instruments

To establish the construct validity, content validity, and reliability of the research instrument, plenty of tests were performed. Next, Cronbach's alpha (CA) coefficient was used to test the instrument's reliability, which was captured by the questionnaire on a Likert scale.

3.7. Ethical Considerations

Informed consent was obtained verbally from the participants after they gave thorough information on the study. The ethics committee approved this. In accordance with relevant guidelines and regulations, all the methods were carried out in this research. Also, the strict privacy and confidentially of information were maintained throughout the study.

4. Result and Discussion

Here, the confirmatory factor analysis of the AI integration on the SAP-ERP development of the healthcare system was identified. Additionally, the barriers and challenges that hinder the integration of AI into the SAP-ERP system in healthcare performance were investigated. A hypothesis of the study has been framed and tested. Lastly, by applying a regression analysis, the significant relation between the variables has been explored and discussed in this section.

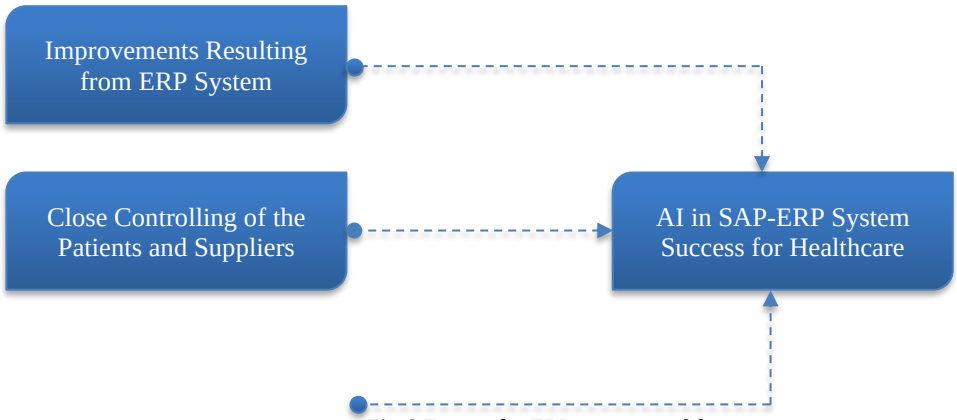

Fig. 2 Factors for ERP success model

Table 1. AI integration on the SAP-ERP development

Variables	Mean	Standard Deviation	Item Loadings	Coefficient Alpha
The improvement resulting from ERP				
The core process of the hospital	3.67	.80	.863	.88
Improvement of quality in product and services	3.59	.88	.775	
Close control of the patients and suppliers				
Data visibility	3.57	.79	.844	.86
Patients' information	3.53	.86	.768	
Internal reporting to the management				
Information quality	3.23	.98	.723	.80
Recording of task	3.33	.95	.741	

Table 2. Barriers that hinder the SAP-ERP system.

Barriers	% Gain
Implementation of project management is poor	93%
Top management is not committed to the system	95%
Strategic goals are not clearly explained	98%
Performance measures are not adopted	72%
Digital transformation is not integrated	69%

4.1. Impact of AI Integration on the SAP-ERP Development of Health Care System

The success factor of the SAP-ERP system in the healthcare setting has been measured by using three influencing variables. Here, the descriptive statistics and factor analysis variables have been measured. Thus, the measurement of the validity of constructs is shown in Table 1.

The confirmatory factor analysis of the various constructs of success factor of AI integration in SAP-ERP development in the health care system has been analyzed. Here, the variables of "Improvement resulting from ERP", "Close controlling of the patients and suppliers", and "Internal reporting to the management" have been taken for the analysis. With the use of convergent and discriminant validity, the instrument validity and reliability have been assessed. Cronbach's Alpha (CA) has been utilized to calculate the scale items' reliability. If CA is below 0.60, then the coefficient of CA is unacceptable. In this analysis, all the constructs have very good internal consistency with alphas of over 0.7. From the findings, it is shown that the variable "Improvement resulting from ERP" achieved the highest CA value in the SAP-ERP success factor in the healthcare setting, which is 0.88.

4.2. Barriers to the Integration of AI on SAP-ERP System

Various barriers hinder the integration of AI on the SAP-ERP system in health care performance, which are listed in Table 2.

Comparing all the barriers, "Strategic goals are not clearly explained" has attained the maximum percentage of the gain value, i.e. 98%. Next, "Top management is not committed to the system" secured the second highest position (95%). Moreover, "Implementation of project management is poor" has attained the third highest value (93%), followed by "Performance measures are not adopted" (72%) and "Digital transformation is not integrated" (69%). The schematic illustration of barriers that hinder the SAP-ERP system is shown in Figure 3.

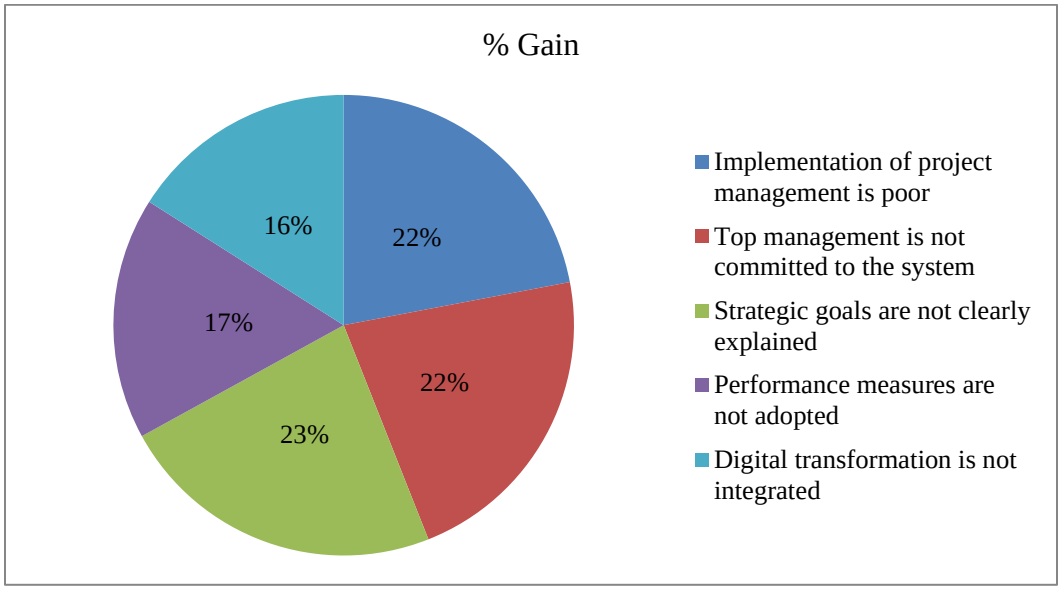

Fig. 3 A graphical illustration of barriers in SAP-ERP

Table 3. Hypothesis testing

Hypothesis	R	R^2	t-value	β-value	p-value	Result
H1	8.23	4.12	3.998	8.233	.000	Accepted
H2	7.88	6.13	4.232	7.491	.000	Accepted
H3	5.32	5.22	2.009	5.999	.000	Accepted

Table 4. Unstandardized and standardized coefficient analysis

	Unstandardized coefficients		Standardized coefficients	t-value	Tolerance	VIF
	B	SD	Beta			
(Constant)	0.589	0.092	0.782	8.24		
The improvement resulting from ERP	0.194	0.090	0.728	9.50	0.84	3.81
Close control of the patients and suppliers	0.178	0.061	0.673	6.77	0.61	3.33
Internal reporting to the management	0.153	0.091	0.624	5.48	0.99	3.75

4.3. Hypothesis Development

H1: The improvement resulting from ERP had a positive development on the integration of AI on SAP-ERP in the success of the healthcare system.

H2: The close control of the patients and suppliers had a positive development on the integration of AI on SAP-ERP in the success of the healthcare system.

H3: The internal reporting to the management had a positive development on the integration of AI on SAP-ERP in the success of the healthcare system. For each hypothesis, the β-value and p-value have been examined. The variable that attained a considered fit of T-statistics at 1.96 or above is considered a positive and significant relationship. Here, the hypothesis of H1 had the highest significant relationship between improvement resulting from ERP and integration of AI on SAP-ERP in the success of the healthcare system (β=8.233, p=0.000). However, the H3 attained a lower significant relationship than the other variables (β=5.999, p=0.000).

4.4. Regression Analysis

Here, the significant coefficient values have been detected by employing the variables in this study, which are shown in Table 4.

Table 4 represents the analysis of unstandardized and standardized coefficients for SA-ERP development in healthcare systems using artificial intelligence. From the analysis, it is revealed that the "Improvement resulting from ERP" achieved the highest β value, which is 0.728, and its SD value is 0.090. Furthermore, it obtained the highest t-value, which is 9.50, and "Internal reporting to the management" obtained the lowest t-value, i.e. 5.48.

5. Conclusion

The goal of this research study is to examine the impact of AI implementation of the SAP-ERP system on the operational factors of the healthcare units. Further, this study explored the barriers to the implementation of AI in the usage of SAP-ERP systems. The significant relationship between the variables has been identified through the regression analysis. The study proved that the improvement resulting from ERP had a positive development on the integration of AI on SAP-ERP in the success of the healthcare system. Further, "improvement resulting from ERP" has the highest positive relations success factor, i.e., β=0.728. Additionally, the study found that most healthcare setting highly face the barrier of "Strategic goals are not clearly explained" in developing the performance of healthcare. The study considered only limited success factors with a limited sample size. However, since the barriers to ERP implementation may vary with respect to the sector, size of the organization, demographic, and geographic region, a study can be done to identify the barriers from the small healthcare units. Further, the other digitalization tools and techniques through other systems can further be studied for the healthcare sector in the Indian context.

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